

**WHAT IS CLAIMED IS:**

1. A projection display comprising:

an illumination module;

an optical modulator for modulating light incident from the illumination module in response to image data; and

a projection optical system for projecting light emitted from the optical modulator on an enlarged scale,

wherein the illumination module comprises:

at least one light source; and

a light recycling unit which causes light emitted from the light source having an emission angle beyond a predetermined range in which light can be effectively projected by the projection optical system to travel within the predetermined range.

2. The projection display of claim 1, wherein the light source includes a light emitting diode.

3. The projection display of claim 2, wherein the light source includes a light emitting diode array on which a plurality of light emitting diodes are arranged.

4. The projection display of claim 1, wherein the light source includes an organic electro-luminescence device.

5. The projection display of claim 1, wherein the light recycling unit includes:

an integrator for guiding light incident from the light source to the optical modulator and including an optical angle converter which changes a propagation angle of light; and

an optical angle selector disposed on an output side of the integrator for selectively transmitting or reflecting light depending on an incident angle of the light.

6. The projection display of claim 5, wherein the integrator includes a light guide in the form of a flat panel through which light propagates by using a total reflection, and the light source projects light to at least one edge surface of the light guide.

7. The projection display of claim 6, wherein the optical angle converter includes a scattering pattern disposed on at least one of a light emitting surface of the light guide and a surface opposite to the light emitting surface.

8. The projection display of claim 6, wherein the optical angle converter includes a diffraction pattern disposed on at least one of the light emitting surface of the light guide and a surface opposite to the light emitting surface.

9. The projection display of claim 5, wherein the integrator includes a light tunnel in the form of a hollow rectangular pipe having a light reflecting surface formed at the inner walls thereof, and the light source radiates light to one end of the light tunnel.

10. The projection display of claim 9, wherein the optical angle converter is located at an end of the light tunnel on the opposite side of the light source.

11. The projection display of claim 5, wherein the integrator includes a light rod in the form of a hollow rectangular pipe made of a transparent material, and the light source radiates light to an end of one side of the light rod.

12. The projection display of claim 11, wherein the optical angle converter is located at an end of the light tunnel on the opposite side of the light source.

13. The projection display of claim 5, wherein the optical angle selector includes a selective transmission member which transmits light emitted from the integrator having an emission angle within a predetermined range in which light can be effectively projected by the projection optical system and reflects light having an emission angle outside of the predetermined range.

14. The projection display of claim 13, wherein the optical angle selector includes a polarization member which transmits only light having a polarization that can pass through the optical modulator and reflects other polarizations, when the optical modulator is a transmission-type optical device which permits only light having a predetermined polarization to pass therethrough.

15. The projection display of claim 14, wherein the polarization member is located on an output side of the selective transmission member.

16. The projection display of claim 13, wherein the optical angle selector further includes a prism sheet on which a pattern of micro prisms whose apex is directed toward the optical modulator is formed.

17. The projection display of claim 16, wherein the prism sheet is interposed between the integrator and the selective transmission member.

18. The projection display of claim 16, wherein the optical angle selector includes an anisotropic diffusion member interposed between the integrator and the prism sheet and adapted to scatter and then transmit light having an incident angle of about 0 degrees and just transmit light incident at other angles.

19. The projection display of claim 5, wherein the optical angle selector includes a prism sheet on which a pattern of micro prisms whose apex is directed toward the optical modulator is formed.

20. The projection display of claim 19, wherein the optical angle selector further includes an anisotropic diffusion member interposed between the integrator and the prism sheet and adapted to scatter and then transmit light having an incident angle of about 0 degrees and just transmit light incident at other angles.

21. The projection display of claim 19, wherein the optical angle selector further includes a polarization member which transmits only light having a polarization which can pass through the optical modulator and reflects other polarizations, when the optical modulator is a transmission-type optical device which permits only light having a predetermined polarization to pass therethrough.

22. A projection display comprising:



an illumination module;

a transmission-type optical modulator for modulating light incident from the illumination module in response to image data; and

a projection optical system for projecting light emitted from the transmission-type optical modulator on an enlarged scale,

wherein the illumination module comprises:

a light guide through which light propagates by a total reflection, and which includes an optical angle converter located on at least one of a light emitting surface thereof and a surface opposite to the light emitting surface, for changing an angle of light propagating through the light guide;

at least one light source for projecting light to at least one edge surface of the light guide; and

a selective transmission member which transmits light emitted from the light guide having an angle within a predetermined range in which light can be effectively projected by the projection optical system and reflects light having an emission angle outside of the predetermined range back to the light guide.

23. The projection display of claim 22, wherein the light source includes a light emitting diode array on which a plurality of light emitting diodes are arranged.

24. The projection display of claim 22, wherein the illumination module further includes a prism sheet on which a pattern of micro prisms whose apex is directed toward the transmission-type optical modulator is formed, the prism sheet being interposed between the light guide and the selective transmission member.

25. The projection display of claim 24, wherein the illumination module further includes an anisotropic diffusion member interposed between the light guide and the prism sheet for scattering and then transmitting light having an incident angle within a total reflection critical angle of the prism sheet and just transmitting light having an incident angle outside the total reflection critical angle.

26. The projection display of claim 22, wherein the illumination module further includes a polarization member disposed on an output side of the selective transmission member for transmitting light having a polarization that can be transmitted through the optical modulator and reflecting other polarizations.

27. A projection display comprising:

- an illumination module;
- a reflection-type optical modulator for modulating light incident from the illumination module in response to image data;
- an illumination optical system for collecting light incident from the illumination module on the reflection-type optical modulator; and
- a projection optical system for projecting light emitted from the reflection-type optical modulator on an enlarged scale,

wherein the illumination module comprises:

- at least one light source;
- an integrator for guiding light incident from a light source to the reflection-type optical modulator and including an optical angle converter which converts a propagation angle of light; and

a prism sheet on which a pattern of micro prisms whose apex is directed toward the optical modulator is formed.

28. The projection display of claim 27, wherein the light source includes a light emitting diode array on which a plurality of light emitting diodes are arranged.

29. The projection display of claim 27, wherein the integrator includes a light tunnel in the form of a hollow rectangular pipe having a light reflecting surface formed at the inner walls thereof, and the light source radiates light to an end of one side of the light tunnel.

30. The projection display of claim 27, wherein the integrator includes a light rod in the form of a hollow rectangular pipe made of a

transparent material, and the light source radiates light to an end of one side of the light rod.

31. The projection display of claim 27, wherein the illumination module further includes an anisotropic diffusion member interposed between the integrator and the prism sheet for scattering and then transmitting light having an incident angle within a total reflection critical angle of the prism sheet and just transmitting light having an incident angle outside the total reflection critical angle.

32. The projection display of claim 31, wherein the illumination module further includes a selective transmission member located on an output side of the prism sheet for transmitting light having an angle within a predetermined range in which light can be effectively projected by the projection optical system and reflecting light having an angle outside of the predetermined range back to the integrator.

33. A projection display comprising:
- a) a prism;
  - b) a projection optical system positioned proximate to a first side of said prism;
  - c) a plurality of liquid crystal panels having a first side and a second side, wherein the first side of the plurality of liquid crystal panels is positioned proximate to opposing sides of the prism;
  - d) a plurality of illumination modules, positioned proximate to the second side of the plurality of liquid crystal panels, and wherein each one of the plurality of illumination modules comprises:
    - a light guide;

at least one light source positioned to emit light

incident on an end of the light guide;

an optical angle converter disposed on a bottom

surface of the light guide;

a reflecting plate positioned proximate to the optical

angle converter; and

a selective transmission member positioned proximate

to a top surface of the light guide.

34. The projection display according to claim 33, wherein each one of the plurality of illumination modules further comprises:

at least one reflecting plate, each one of the at least

one reflecting plates positioned proximate to one



of the at least one light source opposite to the light guide, whereby the each one of the at least one reflecting plates reflects light emitted from one of the at least one light sources onto an end of the light guide.

35. The projection display according to claim 33, wherein each one of the at least one light sources comprises a light emitting diode.
36. The projection display according to claim 33, wherein each one of the least one light sources comprises a plurality of light emitting diodes.
37. The projection display according to claim 33, wherein the each one of the plurality of illumination modules further comprises:

a polarization member positioned proximate to the  
selective transmission member, opposite to the top  
surface of the light guide.

38. A projection display comprising:
- a) a prism;
  - b) a projection optical system positioned proximate to a first  
side of the prism;
  - c) a plurality of liquid crystal panels having a first side and a  
second side, wherein the first side of the plurality of liquid  
crystal panels is positioned proximate to opposing sides of  
the prism;
  - d) a plurality of illumination modules, positioned proximate  
to the second side of the plurality of liquid crystal panels,

and wherein each one of the plurality of illumination

modules comprises:

a light guide;

at least one light source positioned to emit light

incident on an end of the light guide;

at least one reflecting plate, each one of the at least

one reflecting plates positioned proximate to one

of the at least one light source opposite to the light

guide, whereby the each one of the at least one

reflecting plates reflects light emitted from one of

the at least one light source onto an end of the light

guide;

an optical angle converter disposed on a bottom

surface of the light guide;

a reflecting plate positioned proximate to said optical

angle converter;

a selective transmission member positioned proximate

to a top surface of the light guide; and

a polarization member positioned proximate to the

selective transmission member, opposite to the top

surface of the light guide.